AMENDMENTS TO THE CLAIMS

1. (Currently amended) A friction stir welding system that is capable of functionally friction stir welding high melting temperature ferrous and non-ferrous alloys, and superalloys, in a non-planar weld, said friction stir welding system comprising:

a friction stir welding tool having a superabrasive material disposed on at least a portion of the shoulder and the pin, wherein the friction stir welding tool is disposed on a first side of a non-planar surface; and

a support mandrel disposed against a second side of the non-planar surface so as to counteract a force applied by the friction stir welding tool to the first side, wherein the support mandrel is further comprised of:

an inflatable bladder;

a coiled sheet of material that can function as a surface of the support mandrel, wherein the inflatable bladder is disposed inside the coiled sheet, and wherein the inflatable bladder can inflate to uncoil the coiled sheet to thereby press against an inner surface of the non-planar surface.

2. (Previously presented) The system as defined in claim 1 wherein the system further comprises selecting the non-planar

surface from the group of non-planar surfaces comprised of a pipe, flange, tank, and a shroud.

3. (Previously presented) The system as defined in claim 2 wherein the system further comprises means for performing longitudinal friction stir welds along the non-planar surface.

4. (Previously presented) The system as defined in claim 3 wherein the system further comprises means for performing radial friction stir welds along the non-planar surface.

5. (Previously presented) The system as defined in claim 4 wherein the system further comprises the first side of the non-planar surface being an outer diameter (OD) of a pipe, and the second side of the non-planar surface being an inner diameter (ID) of the pipe.

6. (Previously presented) The system as defined in claim 5 wherein the system further comprises the first side of the non-planar surface being the ID of a pipe, and the second side of the non-planar surface being an OD of the pipe.

7. (Previously presented) The system as defined in claim 6 wherein the system further comprises the support mandrel

including a coating to prevent diffusion bonding with the second side of the non-planar surface.

8. (Currently amended) The system as defined in claim 7 wherein the ~~system~~ support mandrel further comprises a movable mandrel that is capable of movement along a length of the pipe.

9. (Previously presented) The system as defined in claim 8 wherein the movable mandrel is capable of movement around the ID of the pipe.

10.-46. (Withdrawn)

47. (New) A friction stir welding system that is capable of functionally friction stir welding high melting temperature ferrous and non-ferrous alloys, and superalloys, in a non-planar weld, said friction stir welding system comprising:

a friction stir welding tool having a superabrasive material disposed on at least a portion of the shoulder and the pin, wherein the friction stir welding tool is disposed on a first side of a non-planar surface; and

a support mandrel disposed against a second side of the non-planar surface so as to counteract a force applied by the friction stir welding tool to the first side, wherein the support

mandrel is further comprised of:

an inflatable bladder;

a segmented material that can function as a surface of the movable mandrel, wherein the inflatable bladder is disposed inside the segmented material, and wherein the inflatable bladder can inflate to cause the segmented material to expand and to thereby press against an inner surface of the non-planar surface.

48. (New) A friction stir welding system that is capable of functionally friction stir welding high melting temperature ferrous and non-ferrous alloys, and superalloys, in a non-planar weld, said friction stir welding system comprising:

a friction stir welding tool having a superabrasive material disposed on at least a portion of the shoulder and the pin, wherein the friction stir welding tool is disposed on a first side of a non-planar surface; and

a support mandrel disposed against a second side of the non-planar surface so as to counteract a force applied by the friction stir welding tool to the first side, wherein the support mandrel is further comprised of a consumable material, wherein the consumable is disposed so as to be pressed against an inner surface of the non-planar surface, and wherein the consumable material can be removed from the inner surface after friction

stir welding is complete, wherein the consumable material provides a counter-force to the friction stir welding tool.

49. (New) A friction stir welding system that is capable of functionally friction stir welding high melting temperature ferrous and non-ferrous alloys, and superalloys, in a non-planar weld, said friction stir welding system comprising:

a friction stir welding tool having a superabrasive material disposed on at least a portion of the shoulder and the pin, wherein the friction stir welding tool is disposed on a first side of a non-planar surface; and

a support mandrel disposed against a second side of the non-planar surface so as to counteract a force applied by the friction stir welding tool to the first side, wherein the support mandrel is further comprised of:

a system of planetary gears, wherein the planetary gears are capable of movement to thereby cause an outer ring to expand or contract, to thereby provide a counter-force to the friction stir welding tool when expanded.

50. (New) A friction stir welding system that is capable of functionally friction stir welding high melting temperature ferrous and non-ferrous alloys, and superalloys, in a non-planar weld, said friction stir welding system comprising:

a friction stir welding tool having a superabrasive material disposed on at least a portion of the shoulder and the pin, wherein the friction stir welding tool is disposed on a first side of a non-planar surface; and

a support mandrel disposed against a second side of the non-planar surface so as to counteract a force applied by the friction stir welding tool to the first side, wherein the support mandrel is further comprised of a wedge, wherein the wedge is capable of being disposed such that it presses against an inner surface of the non-planar surface by friction.

51. (New) A friction stir welding system that is capable of functionally friction stir welding high melting temperature ferrous and non-ferrous alloys, and superalloys, in a non-planar weld, said friction stir welding system comprising:

a friction stir welding tool having a superabrasive material disposed on at least a portion of the shoulder and the pin, wherein the friction stir welding tool is disposed on a first side of a non-planar surface; and

a support mandrel disposed against a second side of the non-planar surface so as to counteract a force applied by the friction stir welding tool to the first side, wherein the support mandrel is further comprised of a segment of the pin that is disposed on an opposite side of the non-planar surface via a

relatively thin connecting segment.

52. (New) A friction stir welding system that is capable of functionally friction stir welding high melting temperature ferrous and non-ferrous alloys, and superalloys, in a non-planar weld, said friction stir welding system comprising:

a friction stir welding tool having a superabrasive material disposed on at least a portion of the shoulder and the pin, wherein the friction stir welding tool is disposed on a first side of a non-planar surface; and

a support mandrel disposed against a second side of the non-planar surface so as to counteract a force applied by the friction stir welding tool to the first side, wherein the support mandrel is further comprised of:

a stopping block;

a plunger having an arm disposed through the stopping block and a plunger end;

a compressible material disposed between the stopping block and the plunger end, wherein the plunger end is moved towards the stopping block to thereby compress the compressible material, which in turn is compressed against an inner surface of the non-planar material.